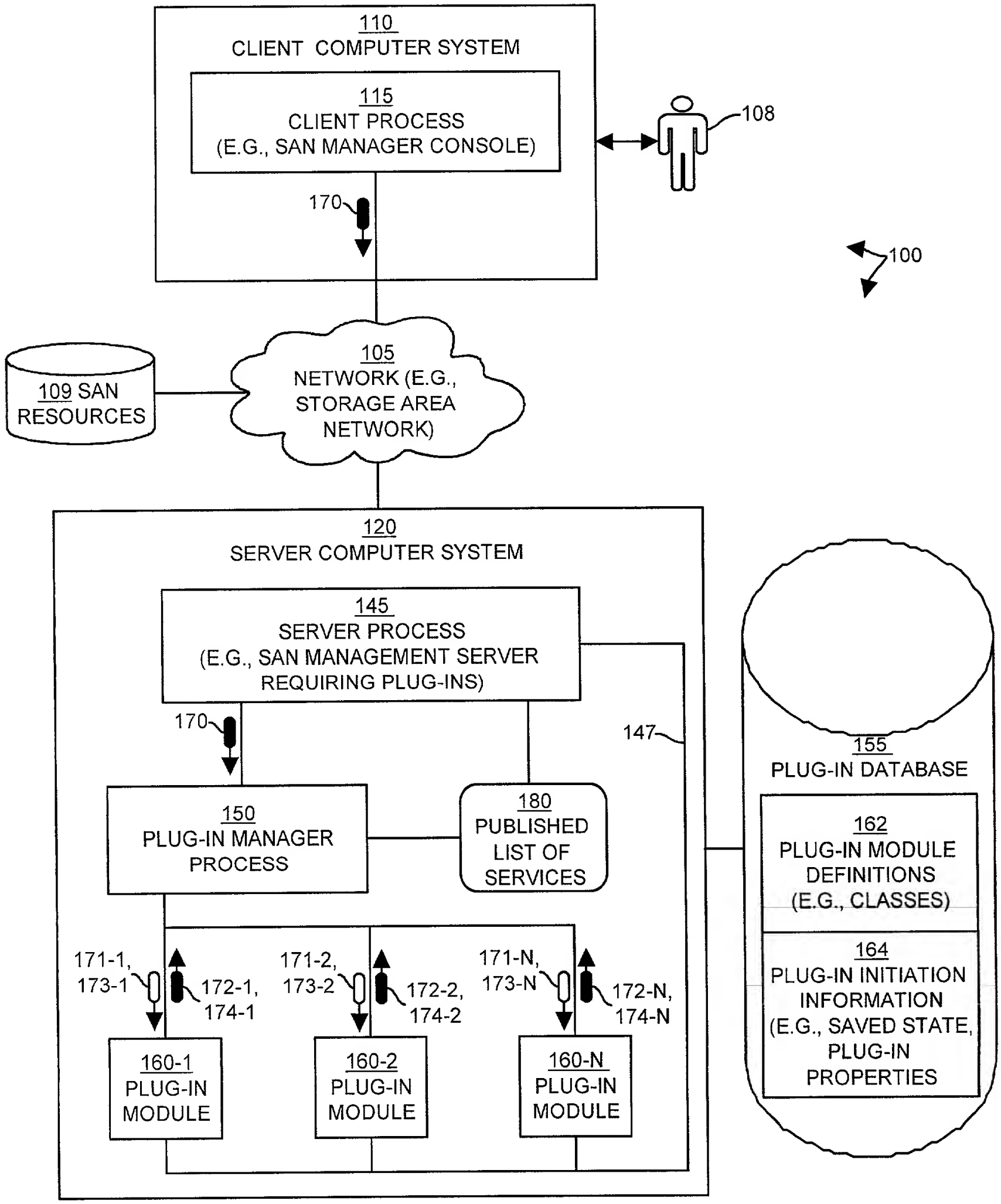
110
CLIENT COMPUTER SYSTEM
115
CLIENT PROCESS
(E.G., SAN MANAGER CONSOLE)
108
170
100
109 SAN
RESOURCES
105
NETWORK (E.G.,
STORAGE AREA
NETWORK)
120
SERVER COMPUTER SYSTEM
145
SERVER PROCESS
(E.G., SAN MANAGEMENT SERVER
REQUIRING PLUG-INS)
170
147
155
PLUG-IN DATABASE
150
PLUG-IN MANAGER
PROCESS
180
PUBLISHED
LIST OF
SERVICES
162
PLUG-IN MODULE
DEFINITIONS
(E.G., CLASSES)
164
PLUG-IN INITIATION
INFORMATION
(E.G., SAVED STATE,
PLUG-IN
PROPERTIES
171-1,
173-1
172-1,
174-1
171-2,
173-2
172-2,
174-2
171-N,
173-N
172-N,
174-N
160-1
PLUG-IN
MODULE
160-2
PLUG-IN
MODULE
160-N
PLUG-IN
MODULE

FIG. 1

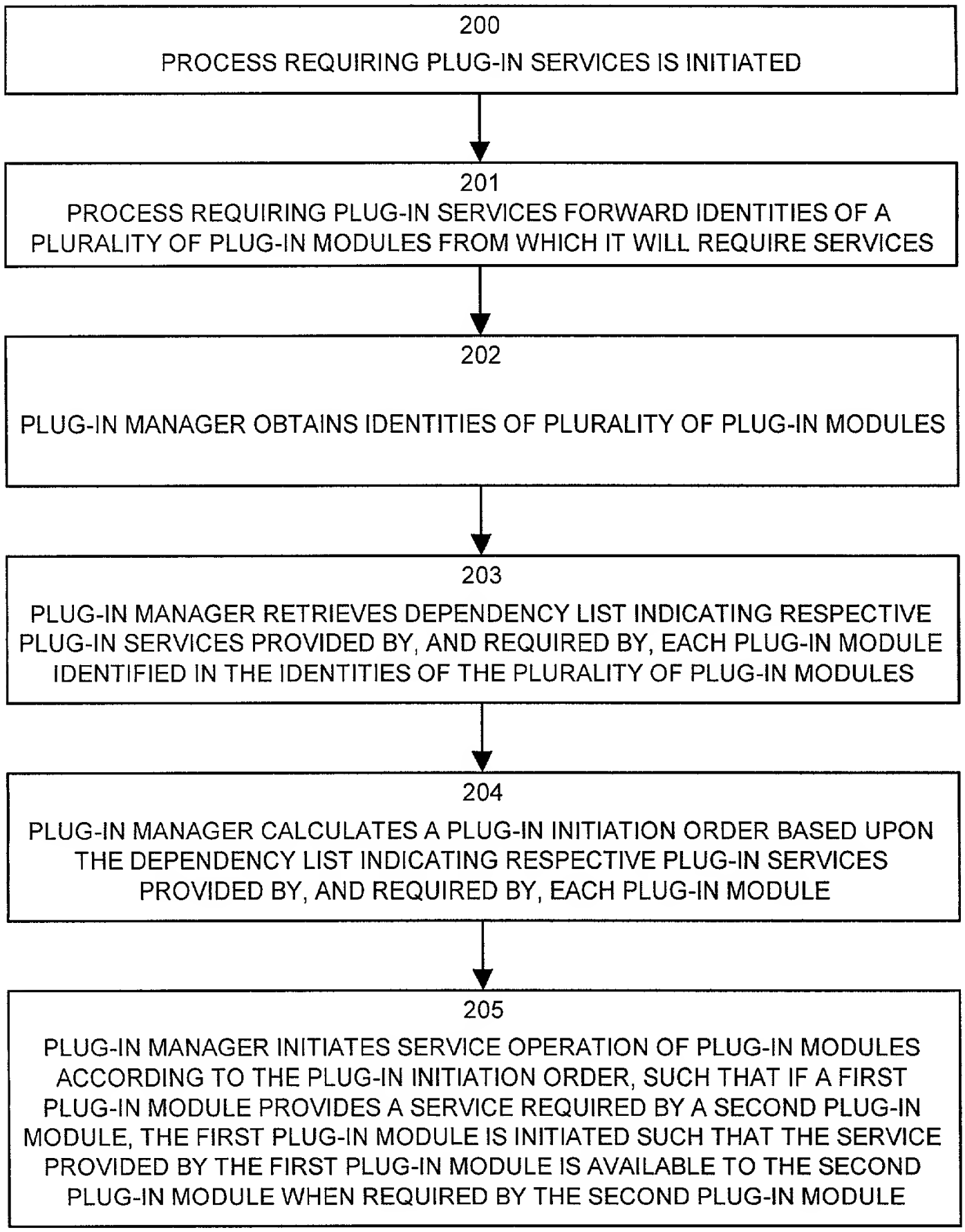
200
PROCESS REQUIRING PLUG-IN SERVICES IS INITIATED
201
PROCESS REQUIRING PLUG-IN SERVICES FORWARD IDENTITIES OF A PLURALITY OF PLUG-IN MODULES FROM WHICH IT WILL REQUIRE SERVICES
202
PLUG-IN MANAGER OBTAINS IDENTITIES OF PLURALITY OF PLUG-IN MODULES
203
PLUG-IN MANAGER RETRIEVES DEPENDENCY LIST INDICATING RESPECTIVE PLUG-IN SERVICES PROVIDED BY, AND REQUIRED BY, EACH PLUG-IN MODULE IDENTIFIED IN THE IDENTITIES OF THE PLURALITY OF PLUG-IN MODULES
204
PLUG-IN MANAGER CALCULATES A PLUG-IN INITIATION ORDER BASED UPON THE DEPENDENCY LIST INDICATING RESPECTIVE PLUG-IN SERVICES PROVIDED BY, AND REQUIRED BY, EACH PLUG-IN MODULE
205
PLUG-IN MANAGER INITIATES SERVICE OPERATION OF PLUG-IN MODULES ACCORDING TO THE PLUG-IN INITIATION ORDER, SUCH THAT IF A FIRST PLUG-IN MODULE PROVIDES A SERVICE REQUIRED BY A SECOND PLUG-IN MODULE, THE FIRST PLUG-IN MODULE IS INITIATED SUCH THAT THE SERVICE PROVIDED BY THE FIRST PLUG-IN MODULE IS AVAILABLE TO THE SECOND PLUG-IN MODULE WHEN REQUIRED BY THE SECOND PLUG-IN MODULE

FIG. 2

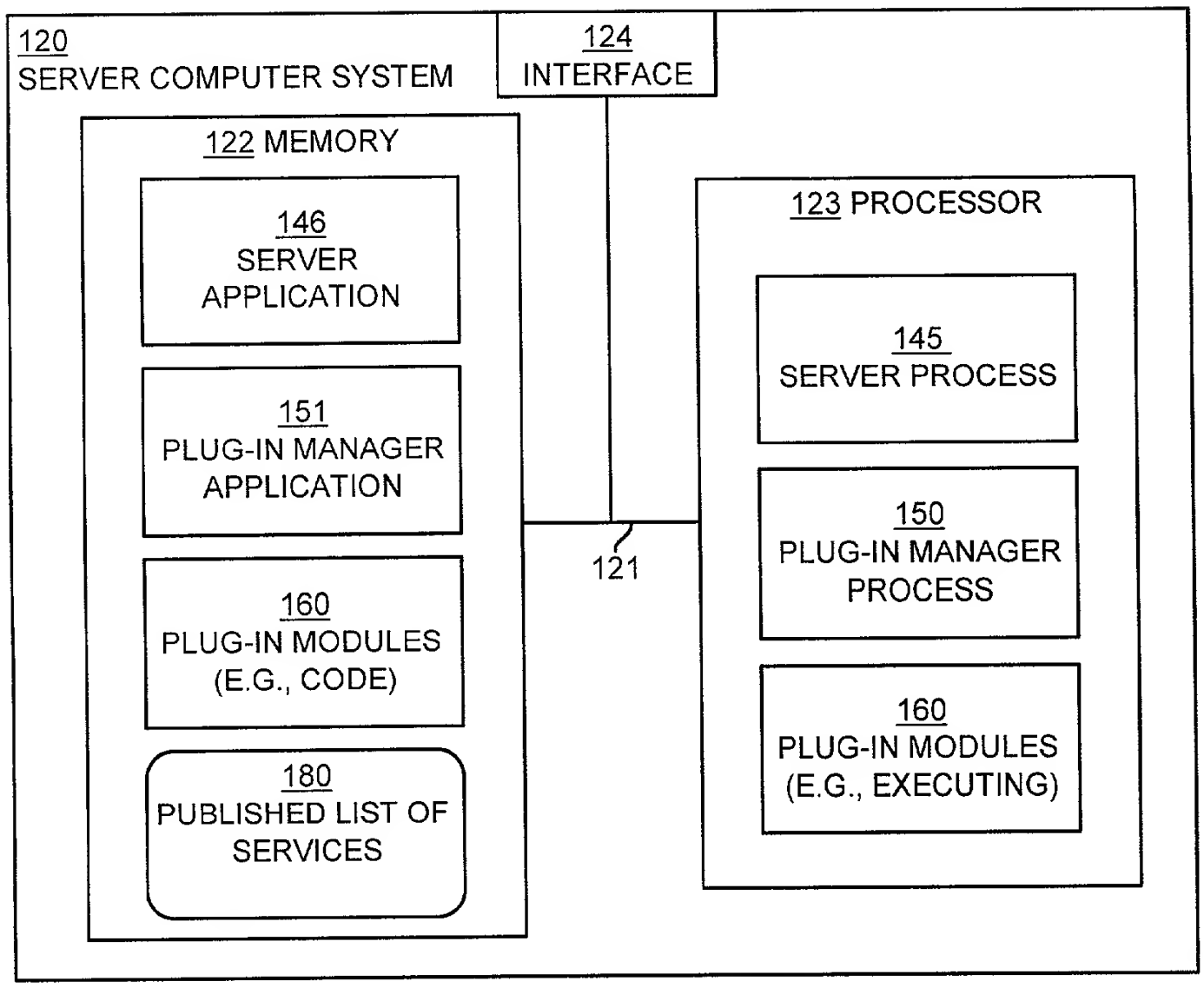
120
SERVER COMPUTER SYSTEM
124
INTERFACE
122 MEMORY
146
SERVER
APPLICATION
151
PLUG-IN MANAGER
APPLICATION
160
PLUG-IN MODULES
(E.G., CODE)
180
PUBLISHED LIST OF
SERVICES
121
123 PROCESSOR
145
SERVER PROCESS
150
PLUG-IN MANAGER
PROCESS
160
PLUG-IN MODULES
(E.G., EXECUTING)

FIG. 3

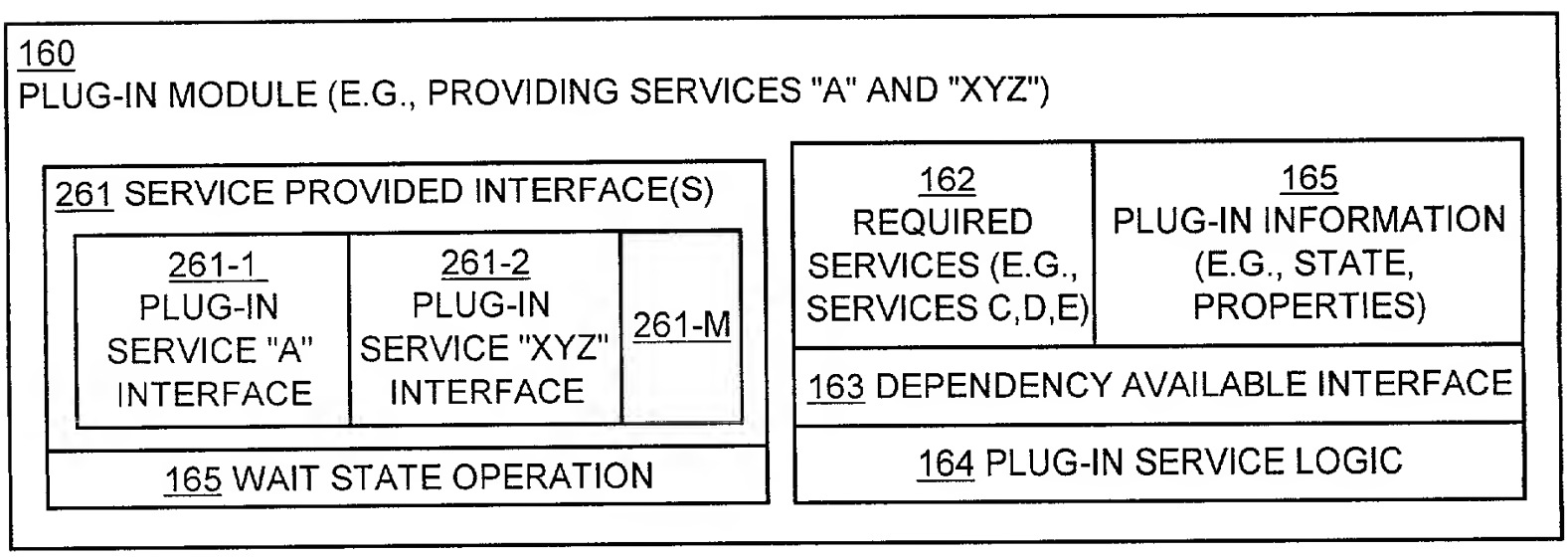
160
PLUG-IN MODULE (E.G., PROVIDING SERVICES "A" AND "XYZ")
261 SERVICE PROVIDED INTERFACE(S)
261-1
PLUG-IN
SERVICE "A"
INTERFACE
261-2
PLUG-IN
SERVICE "XYZ"
INTERFACE
261-M
165 WAIT STATE OPERATION
162
REQUIRED
SERVICES (E.G.,
SERVICES C,D,E)
165
PLUG-IN INFORMATION
(E.G., STATE,
PROPERTIES)
163 DEPENDENCY AVAILABLE INTERFACE
164 PLUG-IN SERVICE LOGIC

FIG. 4

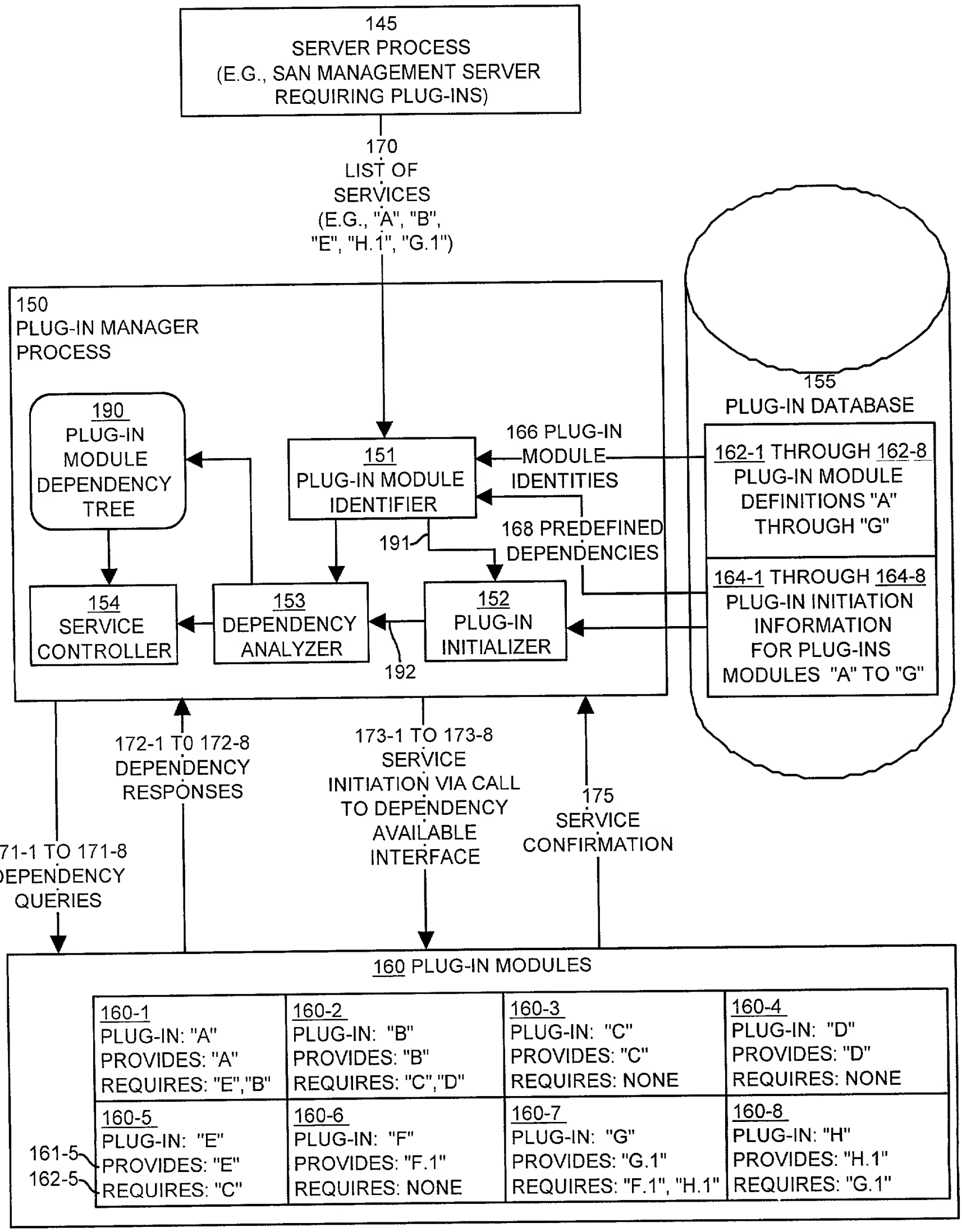
145
SERVER PROCESS
(E.G., SAN MANAGEMENT SERVER
REQUIRING PLUG-INS)
170
LIST OF
SERVICES
(E.G., "A", "B",
"E", "H.1", "G.1")
150
PLUG-IN MANAGER
PROCESS
190
PLUG-IN
MODULE
DEPENDENCY
TREE
151
PLUG-IN MODULE
IDENTIFIER
166 PLUG-IN
MODULE
IDENTITIES
168 PREDEFINED
DEPENDENCIES
191
154
SERVICE
CONTROLLER
153
DEPENDENCY
ANALYZER
152
PLUG-IN
INITIALIZER
192
155
PLUG-IN DATABASE
162-1 THROUGH 162-8
PLUG-IN MODULE
DEFINITIONS "A"
THROUGH "G"
164-1 THROUGH 164-8
PLUG-IN INITIATION
INFORMATION
FOR PLUG-INS
MODULES "A" TO "G"
171-1 TO 171-8
DEPENDENCY
QUERIES
172-1 TO 172-8
DEPENDENCY
RESPONSES
173-1 TO 173-8
SERVICE
INITIATION VIA CALL
TO DEPENDENCY
AVAILABLE
INTERFACE
175
SERVICE
CONFIRMATION
160 PLUG-IN MODULES
160-1
PLUG-IN: "A"
PROVIDES: "A"
REQUIRES: "E","B"
160-2
PLUG-IN: "B"
PROVIDES: "B"
REQUIRES: "C","D"
160-3
PLUG-IN: "C"
PROVIDES: "C"
REQUIRES: NONE
160-4
PLUG-IN: "D"
PROVIDES: "D"
REQUIRES: NONE
160-5
PLUG-IN: "E"
PROVIDES: "E"
REQUIRES: "C"
161-5
162-5
160-6
PLUG-IN: "F"
PROVIDES: "F.1"
REQUIRES: NONE
160-7
PLUG-IN: "G"
PROVIDES: "G.1"
REQUIRES: "F.1", "H.1"
160-8
PLUG-IN: "H"
PROVIDES: "H.1"
REQUIRES: "G.1"

FIG. 5

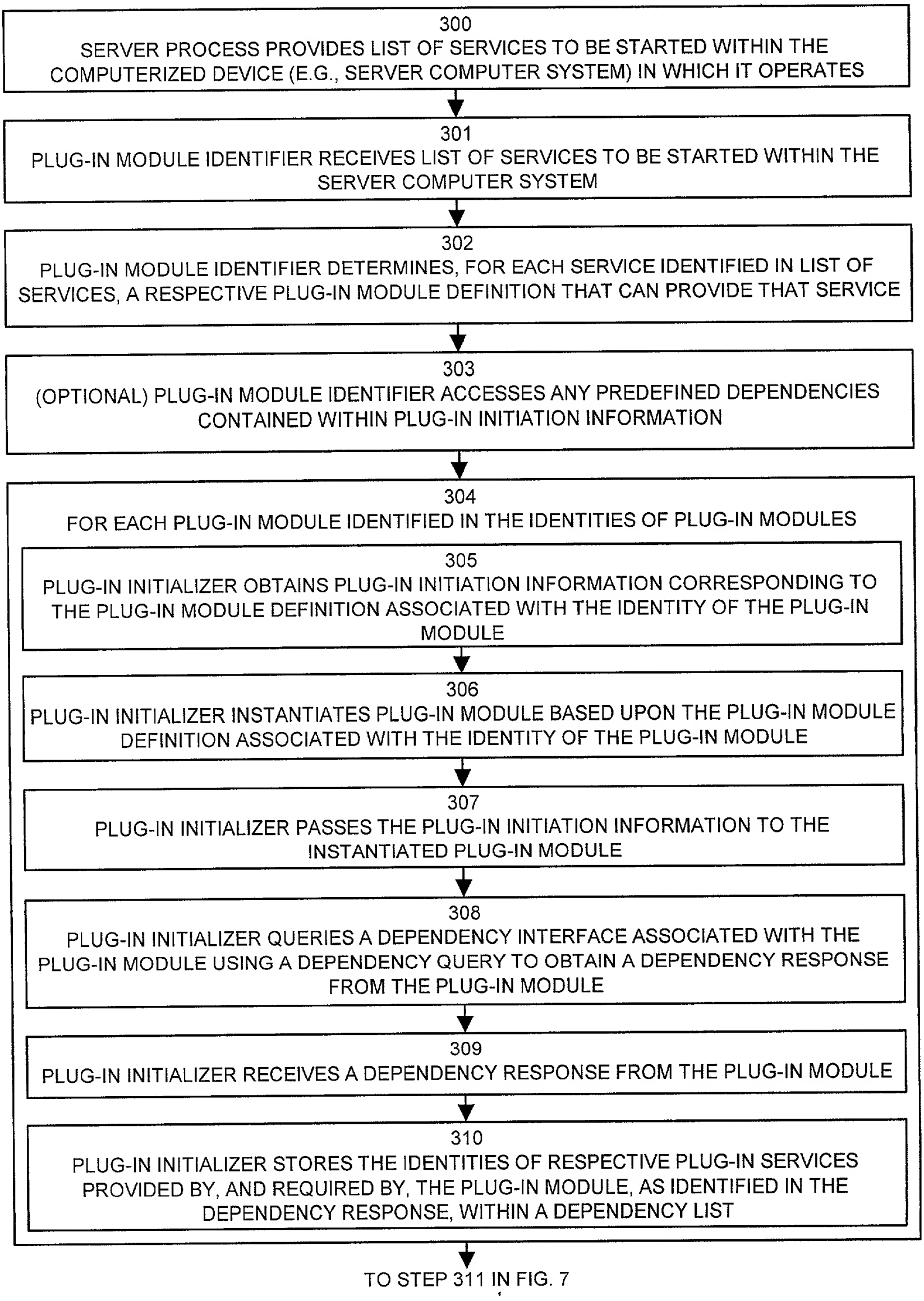
300
SERVER PROCESS PROVIDES LIST OF SERVICES TO BE STARTED WITHIN THE COMPUTERIZED DEVICE (E.G., SERVER COMPUTER SYSTEM) IN WHICH IT OPERATES
301
PLUG-IN MODULE IDENTIFIER RECEIVES LIST OF SERVICES TO BE STARTED WITHIN THE SERVER COMPUTER SYSTEM
302
PLUG-IN MODULE IDENTIFIER DETERMINES, FOR EACH SERVICE IDENTIFIED IN LIST OF SERVICES, A RESPECTIVE PLUG-IN MODULE DEFINITION THAT CAN PROVIDE THAT SERVICE
303
(OPTIONAL) PLUG-IN MODULE IDENTIFIER ACCESSES ANY PREDEFINED DEPENDENCIES CONTAINED WITHIN PLUG-IN INITIATION INFORMATION
304
FOR EACH PLUG-IN MODULE IDENTIFIED IN THE IDENTITIES OF PLUG-IN MODULES
305
PLUG-IN INITIALIZER OBTAINS PLUG-IN INITIATION INFORMATION CORRESPONDING TO THE PLUG-IN MODULE DEFINITION ASSOCIATED WITH THE IDENTITY OF THE PLUG-IN MODULE
306
PLUG-IN INITIALIZER INSTANTIATES PLUG-IN MODULE BASED UPON THE PLUG-IN MODULE DEFINITION ASSOCIATED WITH THE IDENTITY OF THE PLUG-IN MODULE
307
PLUG-IN INITIALIZER PASSES THE PLUG-IN INITIATION INFORMATION TO THE INSTANTIATED PLUG-IN MODULE
308
PLUG-IN INITIALIZER QUERIES A DEPENDENCY INTERFACE ASSOCIATED WITH THE PLUG-IN MODULE USING A DEPENDENCY QUERY TO OBTAIN A DEPENDENCY RESPONSE FROM THE PLUG-IN MODULE
309
PLUG-IN INITIALIZER RECEIVES A DEPENDENCY RESPONSE FROM THE PLUG-IN MODULE
310
PLUG-IN INITIALIZER STORES THE IDENTITIES OF RESPECTIVE PLUG-IN SERVICES PROVIDED BY, AND REQUIRED BY, THE PLUG-IN MODULE, AS IDENTIFIED IN THE DEPENDENCY RESPONSE, WITHIN A DEPENDENCY LIST
TO STEP 311 IN FIG. 7

FIG. 6

311
DEPENDENCY ANALYZER ARRANGES A PLACEMENT OF EACH PLUG-IN MODULE IDENTIFIED IN THE DEPENDENCY LIST WITH A PLUG-IN INITIATION ORDER SUCH THAT PLUG-IN MODULES NOT REQUIRING SERVICES PROVIDED BY OTHER PLUG-IN MODULES ARE PLACED EARLIER IN INITIATION ORDER AND SUCH THAT PLUG-IN MODULES REQUIRING SERVICES PROVIDED BY OTHER PLUG-IN MODULES ARE PLACED LATER IN THE INITIATION ORDER

312
DEPENDENCY ANALYZER ANALYZES THE DEPENDENCY LIST INDICATING RESPECTIVE PLUG-IN SERVICES PROVIDED BY, AND REQUIRED BY, EACH PLUG-IN MODULE IN ORDER TO DETERMINE WHICH PLUG-IN MODULES PROVIDE SERVICES RELIED UPON BY OTHER MODULES

313
DEPENDENCY ANALYZER CREATE AT LEAST ONE PLUG-IN MODULE DEPENDENCY TREE BASED ON DEPENDENCY ANALYSIS

314
SERVICE CONTROLLER TRAVERSES EACH PLUG-IN MODULES DEPENDENCY TREE ACCORDING TO THE HIERARCHICAL ARRANGEMENT OF NOTES AND, FOR EACH NODE ENCOUNTERED IN THE TRAVERSAL, INITIATES SERVICE OPERATION OF THE RESPECTIVE PLUG-IN MODULE ASSOCIATED WITH THAT NODE

315
SERVICE CONTROLLER DETERMINES, FROM A PUBLISHED LIST OF SERVICES AVAILABLE FOR USE, AN IDENTITY OF EACH INITIATED PLUG-IN SERVICE REQUIRED BY THE RESPECTIVE PLUG-IN MODULE

316
SERVICE CONTROLLER FORWARDS, TO THE RESPECTIVE PLUG-IN MODULE, VIA THE DEPENDENCY AVAILABLE INTERFACE ASSOCIATED WITH THAT RESPECTIVE PLUG-IN MODULE, THE IDENTITY OF EACH INITIATED PLUG-IN SERVICE REQUIRED BY THAT RESPECTIVE PLUG-IN MODULE

317
SERVICE CONTROLLER RECEIVES A LIST OF SERVICES INITIATED BY THE RESPECTIVE PLUG-IN MODULE

318
SERVICE CONTROLLER ADDS THE LIST OF SERVICES PROVIDED BY THE RESPECTIVE PLUG-IN MODULE TO THE PUBLISHED LIST OF SERVICES

FIG. 7

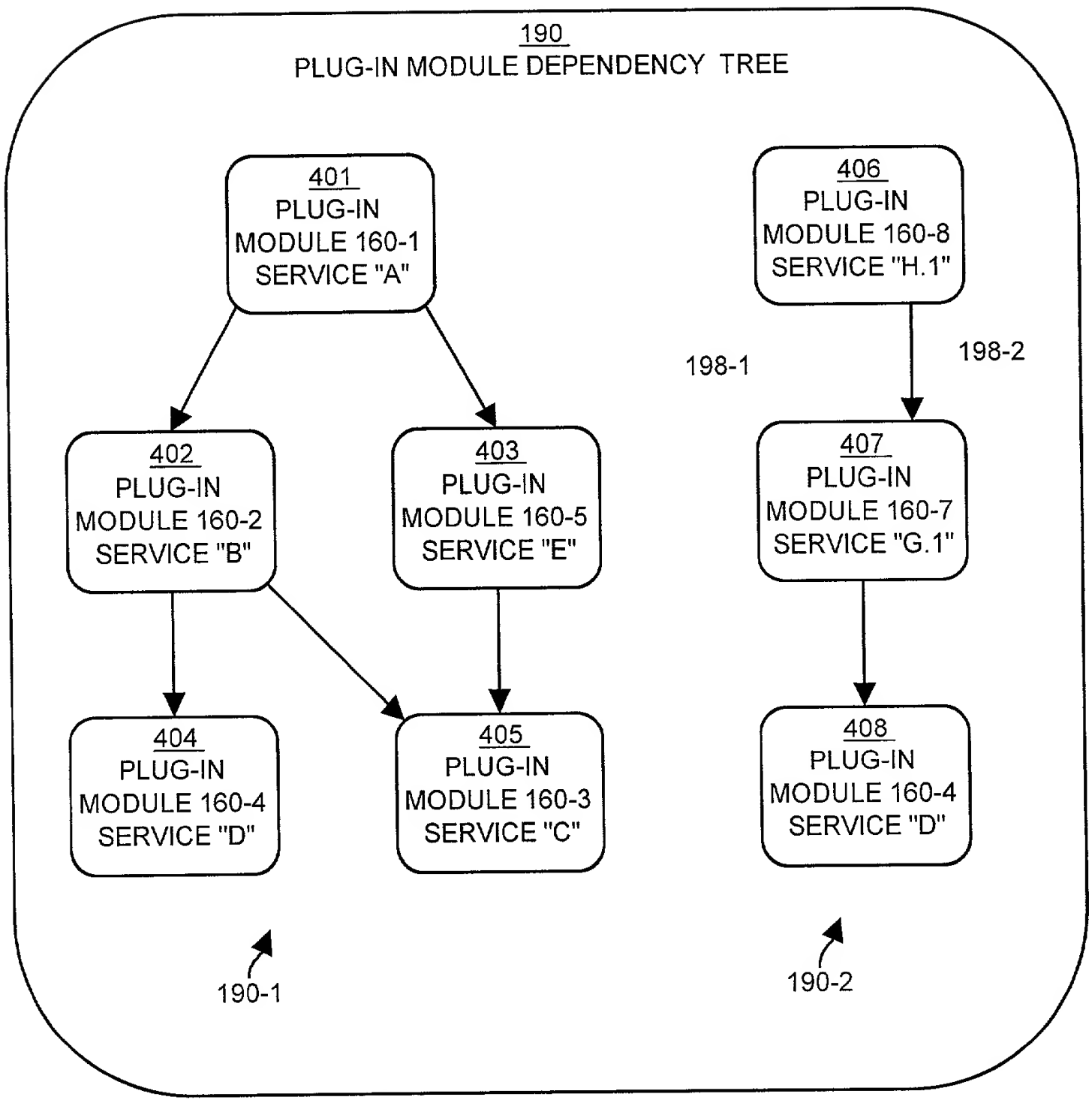
190
PLUG-IN MODULE DEPENDENCY TREE
401
PLUG-IN
MODULE 160-1
SERVICE "A"
406
PLUG-IN
MODULE 160-8
SERVICE "H.1"
198-1
198-2
402
PLUG-IN
MODULE 160-2
SERVICE "B"
403
PLUG-IN
MODULE 160-5
SERVICE "E"
407
PLUG-IN
MODULE 160-7
SERVICE "G.1"
404
PLUG-IN
MODULE 160-4
SERVICE "D"
405
PLUG-IN
MODULE 160-3
SERVICE "C"
408
PLUG-IN
MODULE 160-4
SERVICE "D"
190-1
190-2

FIG. 8